IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Original): A virtual viewpoint image generation method comprising:

a step of obtaining plural images of an object taken by plural cameras;

a step of determining a virtual viewpoint that is a position from which the object is viewed; and

a step of generating a virtual viewpoint image that is an image of the object viewed from the virtual viewpoint based on the obtained images of the object,

the step of generating the virtual viewpoint image comprising:

a step 1 of setting projection planes having a multi-layered structure;

a step 2 of obtaining each corresponding point, on the images of the object, corresponding to a projection point of a projection plane;

a step 3 of determining color information or brightness information of each projection point based on color information or brightness information of corresponding points;

a step of calculating, for each of the projection points overlapping when viewed from a reference viewpoint in a space, a degree of probability that the object exists at a distance corresponding to a position of the projection point based on a degree of correlation of the corresponding points or neighborhoods of the corresponding points;

a step 5 of performing mixing processing on color information or brightness information of reference points overlapping when viewed from the virtual viewpoint according to the degree of probability of existence of the object so as to determine color information or brightness information of each pixel of the virtual viewpoint image; and

a step 6 of repeating steps from the step 1 to the steps 5 for every point corresponding to pixels of the virtual viewpoint image.

Claim 2 (Original): The virtual viewpoint image generation method as claimed in claim 1, the step 3 comprising:

mixing the color information or the brightness information of the corresponding points or selecting the color information or the brightness information of one corresponding point from the color information or the brightness information of the corresponding points.

Claim 3 (Original): The virtual viewpoint image generation method as claimed in claim 1 or 2, the step 4 or the step 5 comprising:

a step of setting, in each reference point on the projection plane, transparency having plural gradations from transparent to opaque by converting the degree of probability that the object exists; and

the step 5 comprising:

performing the mixing processing according to the transparency instead of the degree of probability that the object exists.

Claim 4 (Original): The virtual viewpoint image generation method as claimed in claim 3, the mixing processing of the step 5 comprising:

processing projection points successively from a projection point far from the virtual viewpoint to a projection point near the virtual viewpoint,

wherein color information or brightness information obtained by the mixing processing up to a projection point is obtained by calculating interior division between color information or brightness information at the projection point and color information or brightness information obtained by the mixing processing up to a previous projection point in a ratio according to the transparency.

Claim 5 (Currently Amended): The virtual viewpoint image generation method as claimed in <u>claim 1</u> ~~any one of claims 1-4~~, wherein[[:]]

projection planes specific to each camera taking each image of the object are set in the step 1;

the color information or the brightness information of the step 3 are determined only by using color information or brightness information of the corresponding points of the images of the object taken by the plural cameras;

the degree of probability that the object exists in step 4 is calculated using, as the reference viewpoint, a viewpoint of the camera specific to the projection plane to which the projection point belongs; and

correction is performed based on position relationship between the virtual viewpoint and each reference viewpoint in the mixing processing of the color information or the brightness information.

Claim 6 (Currently Amended): A virtual viewpoint image generation apparatus, comprising:

[[an]] object image obtaining means for obtaining plural images of an object taken by plural cameras;

[[a]] virtual viewpoint determination means for determining a virtual viewpoint that is a position from which the object is viewed; and

[[an]] image generation means for generating a virtual viewpoint image that is an image of the object viewed from the virtual viewpoint based on the obtained images of the object,

the image generation means comprising:

[[a]] projection plane determination means for determining projection planes having a multi-layered structure;

[[a]] reference viewpoint determination means for determining a position of the reference viewpoint;

[[a]] texture array keeping means for keeping an array of texture images to be mapped to the projection planes;

[[a]] corresponding point matching processing means for associating parts, in the images of the object, on which the same region of the object appears with each other;

[[a]] color information determination means for determining color information or brightness information in the array of the texture images by performing mixing processing on the images of the object;

[[an]] existence probability information determination means for calculating a degree of probability that the object exists at a distance corresponding to a position of the projection point in the array of the texture images based on the processing result of the corresponding point matching processing means;

[[a]] rendering means for rendering the projection planes viewed from the virtual viewpoint based on the color information or the brightness information determined by the color information determination means and the existence probability determined by the existence probability determination means.

Claim 7 (Currently Amended): The virtual viewpoint image generation apparatus as claimed in claim 6, the existence probability information determination means comprising:

[[a]] means for setting, in each reference point on the projection plane, transparency having plural gradations from transparent to opaque by converting the degree of possibility that the object exists;

wherein the rendering means performs rendering using the transparency instead of the

degree of possibility that the object exists.

Claim 8 (Currently Amended): The virtual viewpoint image generation apparatus as

claimed in claim 7, the rendering means comprising:

[[a]] means for processing projection points successively from a projection point far

from the virtual viewpoint to a projection point near the virtual viewpoint,

wherein color information or brightness information obtained by the mixing

processing up to a projection point is obtained by calculating interior division between color

information or brightness information at the projection point and color information or

brightness information obtained by the mixing processing up to a previous projection point in

a ratio according to the transparency.

Claim 9 (Currently Amended): The virtual viewpoint image generation apparatus as

claimed in claim 6 any one of claims 6-8, wherein[[:]]

the projection plane determination means determines projection planes specific to

each camera taking each image of the object;

the color information determination means determines the color information or the

brightness information only by using color information or brightness information of the

corresponding points of the images of the object taken by the plural cameras;

the existence probability information determination means calculates the degree of

probability that the object exists by using, as the reference viewpoint, a viewpoint of the

camera specific to the projection plane to which the projection point belongs; and

the rendering means includes a means for performing correction based on position

relationship between the virtual viewpoint and each reference viewpoint.

Claim 10 (Currently Amended): ~~A virtual viewpoint image generation program causing a computer to perform:~~ A computer readable storage medium encoded with a computer readable virtual viewpoint image generation program configured to cause an information processing apparatus to execute a method, the method comprising:

a step of obtaining plural images of an object taken by plural cameras;

a step of determining a virtual viewpoint that is a position from which the object is viewed; and

a step of generating a virtual viewpoint image that is an image of the object viewed from the virtual viewpoint based on the obtained images of the object,

the step of generating the virtual viewpoint image comprising:

a step 1 of setting projection planes having a multi-layered structure;

a step 2 of obtaining each corresponding point, on the images of the object, corresponding to a projection point of a projection plane;

a step 3 of determining color information or brightness information of each projection point based on color information or brightness information of corresponding points;

a step 4 of calculating, for each of the projection points overlapping when viewed from a reference viewpoint in a space, a degree of probability that the object exists at a distance corresponding to a position of the projection point based on a degree of correlation of the corresponding points or neighborhoods of the corresponding points;

a step 5 of performing mixing processing on color information or brightness information of reference points overlapping when viewed from the virtual viewpoint according to the degree of probability of existence of the object so as to determine color information or brightness information of each pixel of the virtual viewpoint image; and

a step 6 of repeating steps from the step 1 to the steps 5 for every point corresponding to pixels of the virtual viewpoint image.

Claim 11 (Canceled).

Claim 12 (Currently Amended): An image generation method, comprising:

a step of obtaining images of an object taken from different viewpoints;

a step of obtaining a three-dimensional shape of the object based on the images; and

a step of generating an image of the object <u>viewable</u> ~~viewed~~ from a viewpoint ~~of an observer~~ based on the obtained three-dimensional shape of the object,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-dimensional shape of the object;

a step of determining color information or brightness information of projection points that are points on the projection planes based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

a step of calculating correlation degrees among corresponding points corresponding to the projection points;

a step of calculating, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that the object exists at the projection point based on the correlation degree of each projection point;

the step of calculating the correlation degree comprising:

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a step of preparing plural groups of camera sets each being a group of some viewpoints selected from the plural viewpoints; and

a step of obtaining the correlation degree from the corresponding points on images included in each camera set,

the step of determining the existence probability comprising:

a step of calculating the existence probability based on the correlation degree of each projection point obtained for each camera set; and

a step of determining the existence probability of each projection point by performing integrating processing for the existence probability determined for each camera set.

Claim 13 (Currently Amended): The image display method as claimed in claim 12, the step of calculating the existence probability based on the correlation degree of each projection point obtained for each camera set comprising:

a step of calculating an evaluation reference value based on the correlation degree ~~degreee~~ of each projection point calculated for each camera set;

a step of calculating a distribution function of the existence probability by performing statistical processing on the evaluation reference value of each projection point calculated for each camera set; and

a step of determining the existence probability of each projection point based on the distribution function of the existence probability.

Claim 14 (Currently Amended): The image generation method as claimed in claim 12 or 13, the step of generating the image of the object viewable ~~viewed~~ from the viewpoint ~~of the observer~~ comprising:

mixing color information or brightness information of the projection points

overlapping when <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the observer~~ in a ratio of the

existence probability to determine color information or brightness information of each point

on the image to be generated so as to generate a two-dimensional image.

Claim 15 (Currently Amended): The image generation method as claimed in claim 12

or 13, the step of generating the image of the object <u>viewable</u> ~~viewed~~ from the viewpoint ~~of~~

~~the observer~~ comprising:

a step of setting plural image generation planes at positions having different depths

when <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the observer~~; and

a step of converting the color information or brightness information and the existence

probability of each projection point into color information or brightness information and a

brightness distribution coefficient on each image generation plane based on position

relationship among projection points overlapping when <u>viewable</u> ~~viewed~~ from the viewpoint

~~of the observer~~ and points on each image generation plane.

Claim 16 (Currently Amended): An image generation, comprising:

[[an]] object image obtaining means for obtaining images of an object taken from

different viewpoints;

[[a]] three-dimensional shape obtaining means for obtaining a three-dimensional

shape of the object based on the images; and

[[an]] object image generation means for generating an image of the object <u>viewable</u>

~~viewed~~ from a viewpoint ~~of an observer~~ based on the obtained three-dimensional shape of the

object,

the three-dimensional shape obtaining means comprising:

[[a]] means for setting projection planes having a multi-layered structure in a virtual three-dimensional space;

[[a]] means for determining a reference viewpoint for obtaining the three-dimensional shape of the object;

[[a]] means for determining color information or brightness information of projection points that are points on the projection planes based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

[[a]] means for calculating correlation degrees among corresponding points corresponding to the projection points;

[[a]] means for determining, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that the object exists at the projection point based on the correlation degree of each projection point;

the means for calculating the correlation degree comprising:

[[a]] means for preparing plural groups of camera sets each being a group of some viewpoints selected from the plural viewpoints; and

[[a]] means for obtaining the correlation degree from the corresponding points on images included in each camera set,

the means for determining the existence probability comprising:

[[a]] means for calculating the existence probability based on the correlation degree of each projection point obtained for each camera set; and

[[a]] means for determining the existence probability of each projection point by performing integrating processing for the existence probability determined for each camera set.

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Claim 17 (Currently Amended): The image generation apparatus as claimed in claim 16, the means for calculating the existence probability based on the correlation degree of each projection point obtained for each camera set comprising:

[[a]] means for calculating an evaluation reference value based on the correlation value of each projection point calculated for each camera set;

[[a]] means for calculating a distribution function of the existence probability by performing statistical processing on the evaluation reference value of each projection point calculated for each camera set; and

[[a]] means for determining the existence probability of each projection point based on the distribution function of the existence probability.

Claim 18 (Currently Amended): The image generation apparatus as claimed in claim 16 or 17, wherein the means for generating the image of the object viewable ~~viewed~~ from the viewpoint ~~of the observer~~ is a means for:

mixing color information or brightness information of the projection points overlapping when viewable ~~viewed~~ from the viewpoint ~~of the observer~~ in a ratio of the existence probability to determine color information or brightness information of each point on the image to be generated so as to determine a two-dimensional image.

Claim 19 (Currently Amended): The image generation apparatus as claimed in claim 16 or 17, the means for generating the image of the object viewable ~~viewed~~ from the viewpoint ~~of the observer~~ comprising:

[[a]] means for setting plural image generation planes at positions having different depths when viewable ~~viewed~~ from the viewpoint ~~of the observer~~; and

[[a]] means for converting the color information or brightness information and the existence probability of each projection point into color information or brightness information and a brightness distribution coefficient on each image generation plane based on position relationship among projection points overlapping <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the observer~~ and points on the image generation planes.

Claim 20 (Currently Amended): ~~An image generation program causing a computer to perform:~~ <u>A computer readable storage medium encoded with a computer readable image generation program configured to cause an information processing apparatus to execute a method, the method comprising:</u>

a step of obtaining images of an object taken from different viewpoints;

a step of obtaining a three-dimensional shape of the object based on the images; and

a step of generating an image of the object <u>viewable</u> ~~viewed~~ from a viewpoint ~~of an observer~~ based on the obtained three-dimensional shape of the object,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-dimensional shape of the object;

a step of determining color information or brightness information of projection points that are points on the projection planes based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

a step of calculating correlation degrees among corresponding points corresponding to the projection points;

a step of calculating, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that the object exists at the projection point based on the correlation degree of each projection point;

the step of calculating the correlation degree comprising:

a step of preparing plural groups of camera sets each being a group of some viewpoints selected from the plural viewpoints; and

a step of obtaining the correlation degree from the corresponding points on images included in each camera set,

the step of determining the existence probability comprising:

a step of calculating the existence probability based on the correlation degree of each projection point obtained for each camera set; and

a step of determining the existence probability of each projection point by performing integrating processing for the existence probability determined for each camera set.

Claim 21 (Canceled).

Claim 22 (Original): An image generation method comprising:

a step of obtaining images of an object taken by changing focusing distance;

a step of obtaining a virtual viewpoint that is a viewpoint from which the object appearing in the images is viewed;

a step of obtaining a three-dimensional shape of the object based on the images; and

a step of generating an image of the object viewed from the virtual viewpoint based on the obtained three-dimensional shape of the object,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-dimensional shape of the object;

a step of determining color information or brightness information of projection points, that are points on the projection planes, based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

a step of determining focusing degrees of the projection points based on focusing degrees of the corresponding points corresponding to the projection points;

a step of calculating, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that the object exists at a distance corresponding to a position of the projection point based on the focusing degree of each projection point;

the step of generating the image of the object viewed from the virtual viewpoint comprising:

mixing color information or brightness information of the projection points overlapping when viewed from the virtual viewpoint in a ratio corresponding to the existence probability to determine color information or brightness information of each point of the image to be generated.

Claim 23 (Original): The image generation method as claimed in claim 22, the step of obtaining the three-dimensional shape of the object or the step of generating the image of the object viewed from the virtual viewpoint comprising:

a step of setting transparency having plural gradations from transparent to opaque on each projection point based on the existence probability of the projection points overlapping when viewed from the reference viewpoint or the virtual viewpoint;

the step of generating the image of the object viewed from the virtual viewpoint comprising:

mixing the color information or the brightness information of the projection points overlapping when viewed from the virtual viewpoint in a ratio according to the transparency set based on the existence probability so as to determine the color information or brightness information of each point of the image to be generated.

Claim 24 (Original): The image generation method as claimed in claim 23,

the step of generating the image of the object viewed from the virtual viewpoint comprising:

mixing the color information or the brightness information for projection points successively from a projection point far from the virtual viewpoint to a projection point near the virtual viewpoint,

wherein color information or brightness information obtained by the mixing processing up to a projection point is obtained by calculating interior division between color information or brightness information at the projection point and color information or brightness information obtained by the mixing processing up to a previous projection point in a ratio according to the transparency.

Claim 25 (Currently Amended): An image generation apparatus, comprising:

[[an]] object image obtaining means for obtaining images of an object taken by changing focusing distance;

[[a]] virtual viewpoint setting means for setting a virtual viewpoint that is a viewpoint from which the object appearing in the images is viewed;

[[a]] three-dimensional shape obtaining means for obtaining a three-dimensional shape of the object based on the images; and

[[a]] rendering means for generating an image of the object viewed from the virtual viewpoint based on the obtained three-dimensional shape of the object,

the three-dimensional shape obtaining means comprising:

[[a]] means for setting projection planes having a multi-layered structure in a virtual three-dimensional space;

[[a]] means for determining a reference viewpoint for obtaining the three-dimensional shape of the object;

[[a]] means for determining color information or brightness information of projection points, that are points on the projection planes, based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

[[a]] means for determining focusing degrees of the projection points based on focusing degrees of the corresponding points corresponding to the projection points;

[[a]] means for determining, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that the object exists at a distance corresponding to a position of the projection point based on the focusing degree of each projection point;

the rendering means comprising:

[[a]] means for mixing color information or brightness information of the projection points overlapping when viewed from the virtual viewpoint in a ratio

corresponding to the existence probability to determine color information or brightness information of each point of the image to be generated.

Claim 26 (Currently Amended): The image generation apparatus as claimed in claim 25, the three-dimensional shape obtaining means or the rendering means comprising:

[[a]] means for setting transparency having plural gradations from transparent to opaque on each projection point based on the existence probability of the projection points overlapping when viewed from the reference viewpoint or the virtual viewpoint; and

the rendering means comprising:

[[a]] means for mixing the color information or the brightness information of the projection points overlapping when viewed from the virtual viewpoint in a ratio according to the transparency set based on the existence probability so as to determine the color information or brightness information of each point of the image to be generated.

Claim 27 (Original): The image generation apparatus as claimed in claim 26,

the rendering means comprising:

a means for mixing the color information or the brightness information for projection points successively from a projection point far from the virtual viewpoint to a projection point near the virtual viewpoint,

wherein color information or brightness information obtained by the mixing processing up to a projection point is obtained by calculating interior division between color information or brightness information at the projection point and color information or brightness information obtained by the mixing processing up to a previous projection point in a ratio according to the transparency.

Claim 28 (Currently Amended): ~~An image generation program for causing a computer to perform:~~ A computer readable storage medium encoded with a computer readable image generation program configured to cause an information processing apparatus to execute a method, the method comprising:

a step of obtaining images of an object taken by changing focusing lengths;

a step of obtaining a virtual viewpoint that is a viewpoint from which the object appearing in the images is viewed;

a step of obtaining a three-dimensional shape of the object based on the images; and

a step of generating an image of the object viewed from the virtual viewpoint based on the obtained three-dimensional shape of the object,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-dimensional shape of the object;

a step of determining color information or brightness information of projection points, that are points on the projection planes, based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

a step of determining focusing degrees of the projection points based on focusing degrees of the corresponding points corresponding to the projection points;

a step of calculating, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that the object exists at a distance corresponding to a position of the projection point based on the focusing degree of each projection point;

the step of generating the image of the object viewed from the virtual viewpoint

comprising:

mixing color information or brightness information of the projection points

overlapping when viewed from the virtual viewpoint in a ratio corresponding to the existence

probability to determine color information or brightness information of each point of the

image to be generated.

Claim 29 (Canceled).

Claim 30 (Currently Amended): An image generation method, comprising:

a step of obtaining images of an object taken under different conditions;

a step of obtaining a three-dimensional shape of the object based on the images; and

a step of generating an image of the object <u>viewable</u> ~~viewed~~ from a viewpoint ~~of an~~

~~observer~~ based on the obtained three-dimensional shape of the object,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual

three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-

dimensional shape of the object;

a step of determining color information or brightness information of projection

points, that are points on the projection planes, based on color information or brightness

information of corresponding points, on the obtained images, corresponding to the projection

points;

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a step of determining, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that a surface of the object exists at the projection point;

the step of determining the existence probability comprising:

a step of calculating an evaluation reference value of each projection point from image information of the corresponding points;

a step of performing statistical processing on the evaluation reference value of each projection point; and

a step of calculating the existence probability of each projection point based on the evaluation reference value on which the statistical processing has been performed.

Claim 31 (Original): The image generation method as claimed in claim 30, the step of obtaining the plural images comprising:

obtaining images by taking the object from different viewpoints;

the step of determining the existence probability comprising:

a step of obtaining correlation degrees among corresponding points corresponding to the projection points;

a step of calculating the evaluation reference value based on the correlation degree of each projection point;

a step of performing the statistical processing on the evaluation reference value; and

a step of calculating the existence probability of each projection point based on the evaluation reference value on which the statistical processing has been performed.

Claim 32 (Original): The image generation method as claimed in claim 30, the step of obtaining the plural images comprising:

obtaining the images of the object taken from a viewpoint by changing focusing distance;

the step of determining the existence probability comprising:

a step of calculating focusing degrees of the projection points from focusing degrees of the corresponding points corresponding to the projection points;

a step of calculating the evaluation reference value based on the focusing degree of each projection point;

a step of performing the statistical processing on the evaluation reference value; and

a step of calculating the existence probability of each projection point based on the evaluation reference value on which the statistical processing has been performed.

Claim 33 (Original): The image generation method as claimed in claim 30, the step of obtaining the plural images comprising:

obtaining images of the object taken from plural viewpoints, and images of the object taken from equal to one or more viewpoints among the plural viewpoints by changing focusing distance;

the step of determining the existence probability comprising:

a step of obtaining correlation degrees between the projection points and corresponding points on the plural images of different viewpoints;

a step of obtaining a first evaluation reference value based on the correlation degrees of each projection point; and

a step of performing the statistical processing on the first evaluation reference value;

a step of calculating focusing degrees of the projection points based on focusing degrees of the corresponding points on the images of different focusing distances;

a step of calculating a second evaluation reference value based on the focusing degrees of each projection point; and

a step of calculating the existence probability of each projection point based on the first evaluation reference value and the second evaluation reference value on which the statistical processing has been performed.

Claim 34 (Currently Amended): The image generation method as claimed in any one of claims 30-33, the step of generating the image of the object <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the observer~~ comprising:

mixing color information or brightness information of the projection points overlapping when <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the observer~~ in a ratio of the existence probability to determine color information or brightness information of each point on the image to be generated so as to determine a two-dimensional image.

Claim 35 (Currently Amended): The image generation method as claimed in any one of claims 30-33, the step of generating the image of the object <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the observer~~ comprising:

a step of setting plural image generation planes at positions having different depths when <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the observer~~; and

a step of converting the color information or brightness information and the existence probability of each projection point into color information or brightness information and a

brightness distribution coefficient on each image generation plane based on position

relationship among projection points overlapping <u>viewable</u> ~~viewed~~ from the viewpoint ~~of the~~

~~observer~~ and points on the image generation planes.

Claim 36 (Currently Amended): An image generation apparatus, comprising:

an object image obtaining means for obtaining images of an object taken under

different conditions;

[[an]] object shape obtaining means for obtaining a three-dimensional shape of the

object based on the images; and

[[an]] object image generation means for generating an image of the object <u>viewable</u>

~~viewed~~ from a viewpoint ~~of an observer~~ based on the obtained three-dimensional shape of the

object,

the object shape obtaining means comprising:

[[a]] means for setting projection planes having a multi-layered structure in a

virtual three-dimensional space;

[[a]] means for determining a reference viewpoint for obtaining the three-

dimensional shape of the object;

[[a]] means for determining color information or brightness information of

projection points, that are points on the projection planes, based on color information or

brightness information of corresponding points, on the obtained images, corresponding to the

projection points;

[[a]] means for determining, for each of the projection points overlapping

when viewed from the reference viewpoint, an existence probability that is a probability that

a surface of the object exists at the projection point;

the means for determining the existence probability comprising:

[[a]] means for calculating an evaluation reference value of each projection point from image information of the corresponding points;

[[a]] means for performing statistical processing on the evaluation reference value of each projection point; and

[[a]] means for calculating the existence probability of each projection point based on the evaluation reference value on which the statistical processing has been performed.

Claim 37 (Currently Amended): The image generation apparatus as claimed in claim 36, wherein the object image obtaining means obtains images of the object taken from different viewpoints;

the means for determining the existence probability comprising:

[[a]] means for obtaining correlation degrees among corresponding points corresponding to the projection points;

[[a]] means for calculating the evaluation reference value based on the correlation degree of each projection point;

[[a]] means for performing the statistical processing on the evaluation reference value; and

[[a]] means for calculating the existence probability of each projection point based on the evaluation reference value on which the statistical processing has been performed.

Claim 38 (Currently Amended): The image generation apparatus as claimed in claim 36, wherein the object image obtaining means obtains the images of the object taken from a viewpoint by changing focusing distance;

the means for determining the existence probability comprising:

[[a]] means for calculating focusing degrees of the projection points from focusing

degrees of the corresponding points corresponding to the projection points;

[[a]] means for calculating the evaluation reference value based on the focusing

degree of each projection point;

[[a]] means for performing the statistical processing on the evaluation reference

value; and

[[a]] means for calculating the existence probability of each projection point based on

the evaluation reference value on which the statistical processing has been performed.

Claim 39 (Currently Amended): The image generation apparatus as claimed in claim

36, wherein the object image obtaining means obtains images of the object taken from plural

viewpoints, and images of the object taken from equal to one or more viewpoints among the

plural viewpoints by changing focusing distance;

the means for determining the existence probability comprising:

[[a]] means for obtaining correlation degrees between the projection points and

corresponding points on the plural images having different projection points;

[[a]] means for obtaining a first evaluation reference value based on the correlation

degrees of each projection point; and

[[a]] means for performing the statistical processing on the first evaluation reference

value;

[[a]] means for calculating focusing degrees of the projection points based on

focusing degrees of the corresponding points on the images of different focusing distances

taken from a viewpoint;

[[a]] means for calculating a second evaluation reference value based on the focusing

degrees of each projection point; and

[[a]] means for calculating the existence probability of each projection point based on the first evaluation reference value and the second evaluation reference value on which the statistical processing has been performed.

Claim 40 (Currently Amended): The image generation apparatus as claimed in any one of claims 36-39, the means for generating the image of the object viewable ~~viewed~~ from the viewpoint ~~of the observer~~ comprising:

[[a]] means for mixing color information or brightness information of the projection points overlapping when viewable ~~viewed~~ from the viewpoint ~~of the observer~~ in a ratio of the existence probability to determine color information or brightness information of each point on the image to be generated so as to determine a two-dimensional image.

Claim 41 (Currently Amended): The image generation apparatus as claimed in any one of claims 36-39, the means for generating the image of the object viewable ~~viewed~~ from the viewpoint ~~of the observer~~ comprising:

[[a]] means for setting plural image generation planes at positions having different depths when viewable ~~viewed~~ from the viewpoint ~~of the observer~~; and

[[a]] eans for converting the color information or brightness information and the existence probability of each projection point into color information or brightness information and a brightness distribution coefficient on each image generation plane based on position relationship among projection points overlapping viewable ~~viewed~~ from the ~~viewpoint of the observer~~ and points on the image generation planes.

Claim 42 (Currently Amended): ~~An image generation program causing a computer to perform:~~ A computer readable storage medium encoded with a computer readable image

generation program configured to cause an information processing apparatus to execute a method, the method comprising:

a step of obtaining images of an object taken under different conditions;

a step of obtaining a three-dimensional shape of the object based on the images; and

a step of generating an image of the object viewable ~~viewed~~ from a viewpoint ~~of an observer~~ based on the obtained three-dimensional shape of the object,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-dimensional shape of the object;

a step of determining color information or brightness information of projection points, that are points on the projection planes, based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

a step of determining, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that a surface of the object exists at the projection point;

the step of determining the existence probability comprising:

a step of calculating an evaluation reference value of each projection point from image information of the corresponding points;

a step of performing statistical processing on the evaluation reference value of each projection point; and

a step of calculating the existence probability of each projection point based on the evaluation reference value on which the statistical processing has been performed.

Claim 43 (Canceled).

Claim 44 (Currently Amended): A three-dimensional image display method,
comprising:

a step of obtaining images of an object taken under different conditions;

a step of obtaining a three-dimensional shape of the object based on the images;

a step of setting a viewpoint position such that from which an observer observes

plural image display planes existing at different depth positions are viewable when viewed

from the observer;

a step of generating two-dimensional images to be displayed on each image display

plane based on the obtained three-dimensional shape of the object; and

a step of presenting a three-dimensional image of the object by displaying the

generated two-dimensional images on each display plane,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual

three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-

dimensional shape of the object;

a step of determining color information or brightness information of projection

points, that are points on the projection planes, based on color information or brightness

information of corresponding points, on the obtained images, corresponding to the projection

points;

a step of determining, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that a surface of the object exists at the projection point;

the step of generating the two-dimensional images comprising:

converting the color information or the brightness information and the existence probability of the projection point into color information or brightness information and existence probability of each display point that is a point on the image display plane corresponding to the projection plane on which the projection point exists so as to generate the two dimensional images;

the step of presenting the three-dimensional image of the object comprising:

displaying the color information or brightness information on each display point with brightness according to the existence probability.

Claim 45 (Original): The three-dimensional image display method as claimed in claim 44, the step of obtaining the plural images comprising:

obtaining images of the object taken from different viewpoints,

the step of determining the existence probability comprising:

a step of calculating correlation degrees among corresponding points corresponding to the projection points;

a step of determining, for projection points overlapping when viewed from the reference viewpoint, the existence probability of each projection point based on the correlation degree of each projection point.

Claim 46 (Original): The three-dimensional image display method as claimed in claim 44, the step of obtaining the plural images comprising:

obtaining images of the object taken from a viewpoint by changing focusing distance,

the step of determining the existence probability comprising:

a step of calculating focusing degrees of the projection points from focusing

degrees of corresponding points corresponding to the projection points;

a step of determining, for projection points overlapping when viewed from the

reference viewpoint, the existence probability of each projection point based on the focusing

degree of each projection point.

Claim 47 (Original): The three-dimensional image display method as claimed in

claim 44, the step of obtaining the plural images comprising:

obtaining images of the object taken from plural viewpoints, and images of the object

taken from equal to one or more viewpoints among the plural viewpoints by changing

focusing distance;

the step of determining the existence probability comprising:

a step of obtaining correlation degrees between the projection points and

corresponding points on the plural images of different viewpoints;

a step of calculating focusing degrees of the projection points based on

focusing degrees of the corresponding points on the images, having different focusing

distance, of each viewpoint; and

a step of determining, for projection points overlapping when viewed from the

reference viewpoints, the existence probability of each projection point based on the

correlation degree and the focusing degree of each projection point.

Claim 48 (Currently Amended): A three-dimensional image display apparatus

comprising:

an object image obtaining means for obtaining images of an object taken under different conditions;

[[a]] three-dimensional shape obtaining means for obtaining a three-dimensional shape of the object based on the images;

~~an observer-viewpoint setting~~ means for setting a viewpoint position <u>such that</u> ~~from which an observer observes~~ plural image display planes existing at different depth positions <u>are viewable</u> ~~when viewed from the observer~~;

[[a]] two-dimensional image generation means for generating two-dimensional images to be displayed on each image display plane based on the obtained three-dimensional shape of the object; and

wherein the three-dimensional image display apparatus presents a three-dimensional image of the object by displaying the generated two-dimensional images on each display plane,

the three-dimensional shape obtaining means comprising:

[[a]] means for setting projection planes having a multi-layered structure in a virtual three-dimensional space;

[[a]] means for determining a reference viewpoint for obtaining the three-dimensional shape of the object;

[[a]] means for determining color information or brightness information of projection points, that are points on the projection planes, based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

[[a]] means for determining, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that a surface of the object exists at the projection point;

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the two-dimensional image generation means comprising:

[[a]] means for converting the color information or the brightness information and the existence probability of the projection point into color information or brightness information and existence probability of each display point that is a point on the image display plane corresponding to the projection plane on which the projection point exists to generate the two dimensional images;

wherein the three-dimensional image display apparatus displays the color information or brightness information on each display point with brightness according to the existence probability.

Claim 49 (Currently Amended): The three-dimensional image display apparatus as claimed in claim 48, wherein the object image obtaining means is a means for obtaining images of the object taken from different viewpoints,

the means for determining the existence probability comprising:

[[a]] means for calculating correlation degrees among corresponding points corresponding to the projection points;

[[a]] means for determining, for projection points overlapping when viewed from the reference viewpoint, the existence probability of each projection point based on the correlation degree of each projection point.

Claim 50 (Currently Amended): The three-dimensional image display apparatus as claimed in claim 48, wherein the object image obtaining means is a means for obtaining images of the object taken from a viewpoint by changing focusing distance,

the means for determining the existence probability comprising:

[[a]] means for calculating focusing degrees of the projection points from focusing degrees of corresponding points corresponding to the projection points; and

[[a]] means for determining, for projection points overlapping when viewed from the reference viewpoint, the existence probability of each projection point based on the focusing degree of each projection point.

Claim 51 (Currently Amended): The three-dimensional image display apparatus as claimed in claim 48, wherein the object image obtaining means is a means for obtaining images of the object taken from plural viewpoints, and images of the object taken from equal to one or more viewpoints among the plural viewpoints by changing focusing distance;

the means for determining the existence probability comprising:

[[a]] means for obtaining correlation degrees between the projection points and corresponding points on the plural images of different viewpoints;

[[a]] means for calculating focusing degrees of the projection points based on focusing degrees of the corresponding points on the images, having different focusing length, of each viewpoint; and

[[a]] means for determining, for projection points overlapping when viewed from the reference viewpoints, the existence probability of each projection point based on the correlation degree and the focusing degree of each projection point.

Claim 52 (Currently Amended): A three-dimensional image display program causing a computer to perform: A computer readable storage medium encoded with a computer readable three-dimensional image display program configured to cause an information processing apparatus to execute a method, the method comprising:

a step of obtaining images of an object taken under different conditions;

a step of obtaining a three-dimensional shape of the object based on the images;

a step of setting a viewpoint position <u>such that</u> ~~from which an observer observes~~ plural image display planes existing at different depth positions <u>are viewable</u> ~~when viewed from the observer~~;

a step of generating two-dimensional images to be displayed on each image display plane based on the obtained three-dimensional shape of the object; and

a step of presenting a three-dimensional image of the object by displaying the generated two-dimensional images on each display plane,

the step of obtaining the three-dimensional shape of the object comprising:

a step of setting projection planes having a multi-layered structure in a virtual three-dimensional space;

a step of determining a reference viewpoint for obtaining the three-dimensional shape of the object;

a step of determining color information or brightness information of projection points, that are points on the projection planes, based on color information or brightness information of corresponding points, on the obtained images, corresponding to the projection points;

a step of determining, for each of the projection points overlapping when viewed from the reference viewpoint, an existence probability that is a probability that a surface of the object exists at the projection point;

the step of generating the two-dimensional images comprising:

a step of converting the color information or the brightness information and the existence probability of the projection point into color information or brightness information and existence probability of each display point that is a point on the image

display plane corresponding to the projection plane on which the projection point exists to

generate the two dimensional images;

the step of presenting the three-dimensional image of the object comprising:

a step of displaying the color information or brightness information on each

display point with brightness according to the existence probability.

Claim 53 (Canceled).